SEEDS 4

.6
13
981
r.4
3

URR

THIS BOOK IS THE PROPERTY OF:

STATE _____
PROVINCE _____
COUNTY _____
PARISH _____
SCHOOL DISTRICT _____
OTHER _____

Book No. _____
Enter information in spaces to the left as instructed

ISSUED TO	Year Used	CONDITION	
		ISSUED	RETURNED

PUPILS to whom this textbook is issued must not write on any page or mark any part of it in any way, consumable textbooks excepted.

1. Teachers should see that the pupil's name is clearly written in ink in the spaces above in every book issued.
2. The following terms should be used in recording the condition of the book: New; Good; Fair; Poor; Bad.

SEEDS 4

The Energy Literacy Series

SRA

SCIENCE RESEARCH ASSOCIATES (CANADA) LIMITED
Toronto, Montreal, Chicago, Palo Alto, Sydney, Henley-on-Thames, Paris

SEEDS 4
WRITING TEAM: Mervyn Lynch, Gwen Carriere, Larry Hlushak, Lorna Hornby, Sandra Margetts
REVISION TEAM: Donna Barge, Bernie Galbraith, Chris Jackson, Wayne Newbert
PROGRAM DIRECTOR: Hugh Phillips

SRA
EDITORIAL TEAM: Sylvia Hill, Sherry Henderson, Joe Sobura, Karin Velcheff
PRODUCTION COORDINATOR: Shelagh Roberts

DESIGN: Condy / Morrison
ILLUSTRATION: Roy Condy, Donald Morrison

ACKNOWLEDGEMENTS:
Every effort has been made to identify and credit appropriately the sources of all copyright material used in this book. Any information concerning perceived errors or omissions will be appreciated, and the correct source acknowledged in subsequent editions.

Page 12. Reprinted by permission of Science Research Associates (Canada) Limited. © 1969 by Science Research Associates (Canada) Limited, and Science Research Associates Limited, and Science Research Associates Pty. Ltd.

Photographs by permission of the following:
Bucyrus-Erie Company, 25; © George Hunter / The Image Bank of Canada, 14; Imperial Oil Limited, 20, 21; Joy Manufacturing Company, 25; © M. L. Osborne / The Image Bank of Canada, 26; © John de Visser / The Image Bank of Canada, 21.

Copyright © Society, Environment & Energy Development Studies Foundation, 1981.
Published by Science Research Associates (Canada) Limited.
All rights reserved. Printed in Canada.

No part of this publication may be reproduced or transmitted in any form, including any storage or retrieval system, or by any means, electronic, mechanical, photographic, or recording, without permission in writing from the publisher, except as granted at publication for specified pages.

Printing History
1 2 3 4 5 6 7 8 9 0 90 89 88 87 86 85 84 83 82 81

LIBRARY
UNIVERSITY OF ALBERTA

ACTIVITY 1

What is Energy?

Where does it come from?

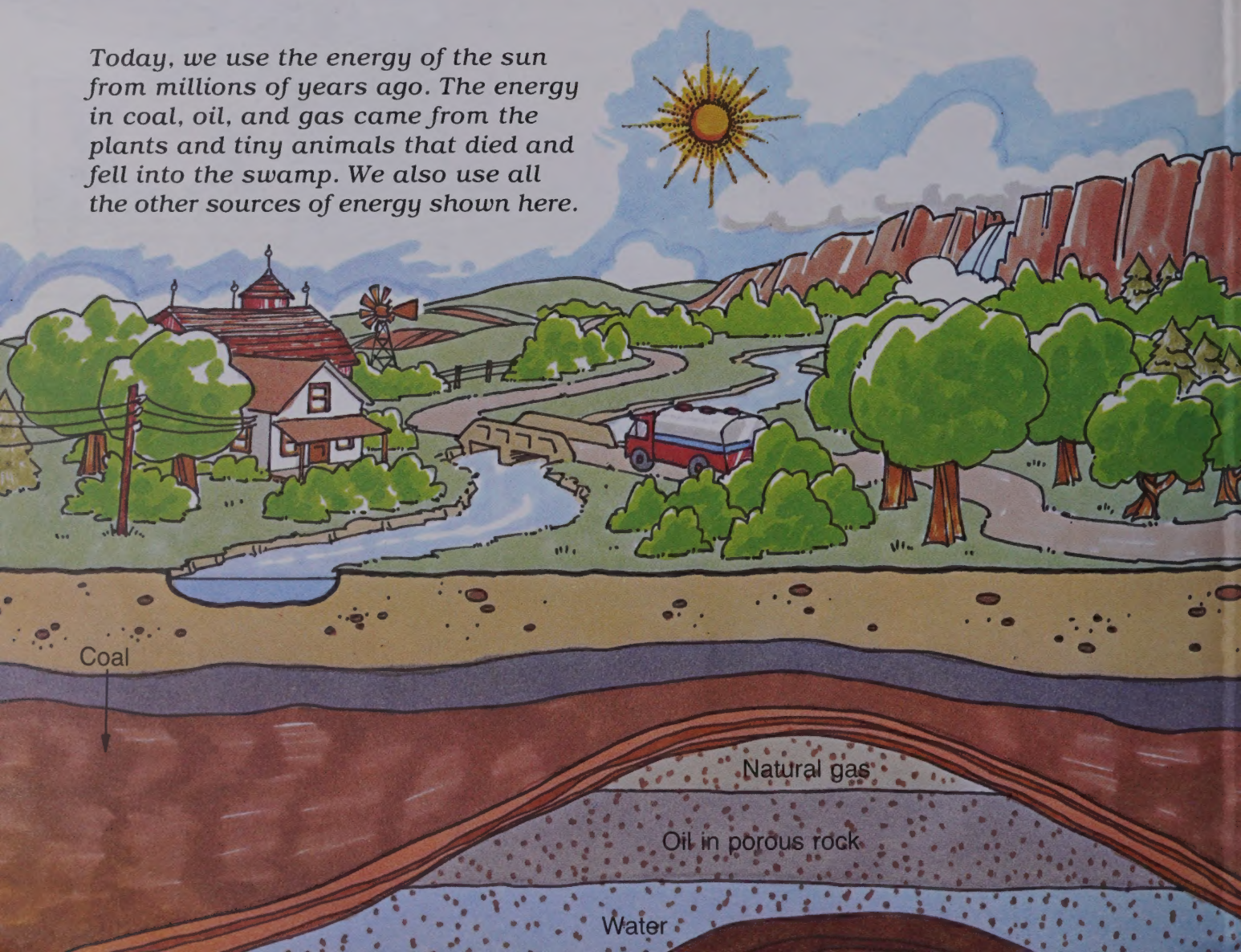
The wall plug?

The gas station?

Energy: The Sun

Millions of years ago, the sun shone on these plants and made them grow. When they died, they fell into the swamp.

Today, we use the energy of the sun from millions of years ago. The energy in coal, oil, and gas came from the plants and tiny animals that died and fell into the swamp. We also use all the other sources of energy shown here.



ACTIVITY 3

Renewable and Nonrenewable

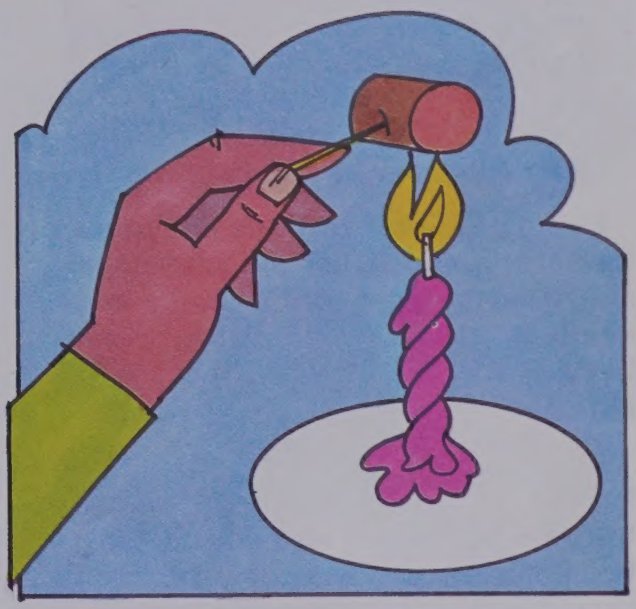
Part A

Each group will need:
1 wiener cube per child
toothpicks
3-cm piece of birthday candle mounted on saucer

1. Put the wiener cubes on the toothpicks.
2. When your teacher lights the candle for your group, cook your wiener cube for one minute or until the flame goes out.

Answer these questions:

1. How many wiener cubes were cooked by the candle?
2. How hot were they? (warm, hot, or very hot)

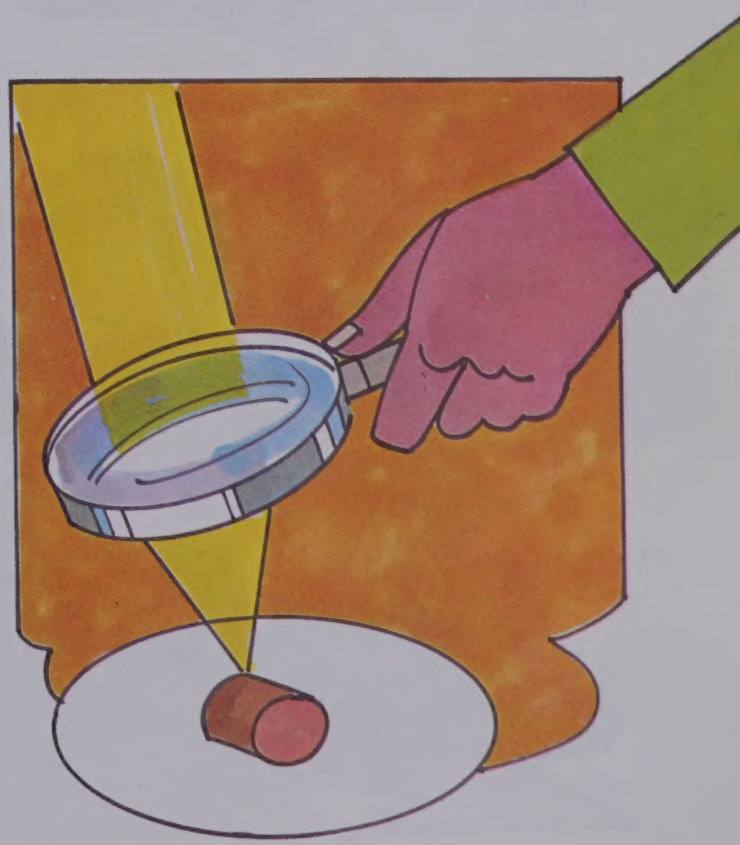


3. Can the candle be used again? Why or why not?

Part B

Each group will need:
1 wiener cube per child
toothpicks
1 large magnifying glass
1 aluminum pie plate

1. Put one wiener cube on the pie plate.
2. Focus the bright dot of light from the magnifying glass on the wiener cube.
3. Cook wiener cube for three minutes. DO NOT PUT YOUR HANDS UNDER THE MAGNIFYING GLASS. YOU MIGHT GET BURNED.
4. Use the toothpick to pick up your wiener cube once the cooking period is over.



Answer these questions:

1. How many wiener cubes were cooked by the sun?
2. How hot were they?
3. Can the magnifying glass and sunlight be reused? Why or why not?
4. Can you cook wieners this way in your kitchen? at night?

Using your observations and answers for Parts A and B, list the advantages and disadvantages of the candle and sunlight as sources of heat for cooking. Use the chart on Activity Sheet 2, Part 1.

Part C

In the experiments we just did, we used two different sources of heat. The candle was a nonrenewable source. When it burned down and went out, we couldn't light it again. Sunlight is a renewable source. We can use it again and again, as long as the sun is shining. The heat we needed to cook the wieners is a form of energy. Candles and sunlight are sources of heat energy. We use many other sources of energy every day.

Some energy sources are renewable. Some are nonrenewable. Remember: nonrenewable energy sources are like the candle — you can only use them once. Renewable sources are like sunlight — they can be used over and over again. If you are trying to decide whether a form of energy is renewable or not, ask yourself: Can this form of energy be used again and again? Will it come back, like the sun, day after day?

Turn to Part 2 of your Activity Sheet. Complete the chart by placing a check mark in the column that tells whether the source of energy listed is renewable or nonrenewable.

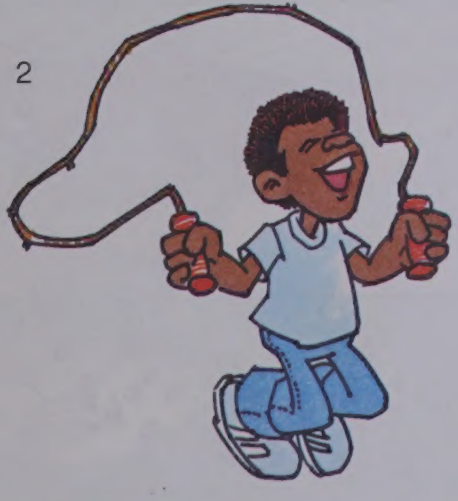
ACTIVITY 4

The Energy We've Used

Write the number of the energy-using activity in your notebook. Then copy the sentence that tells you the source of energy for the activity.

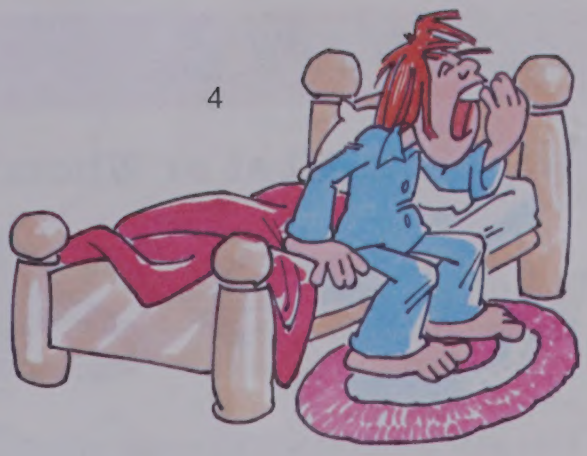
1

2

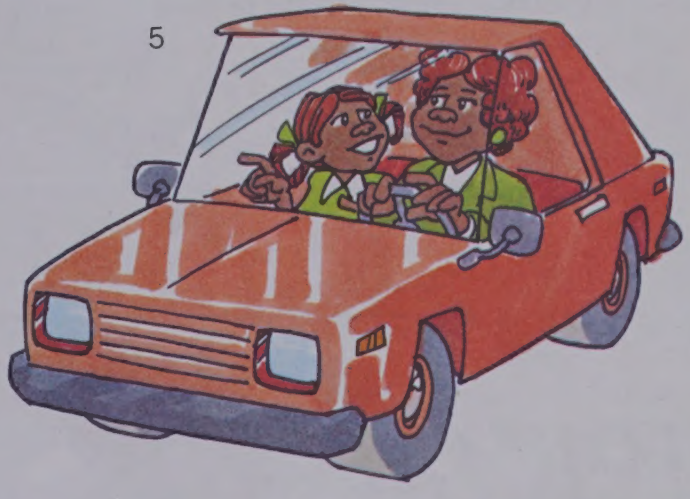


3

4



5

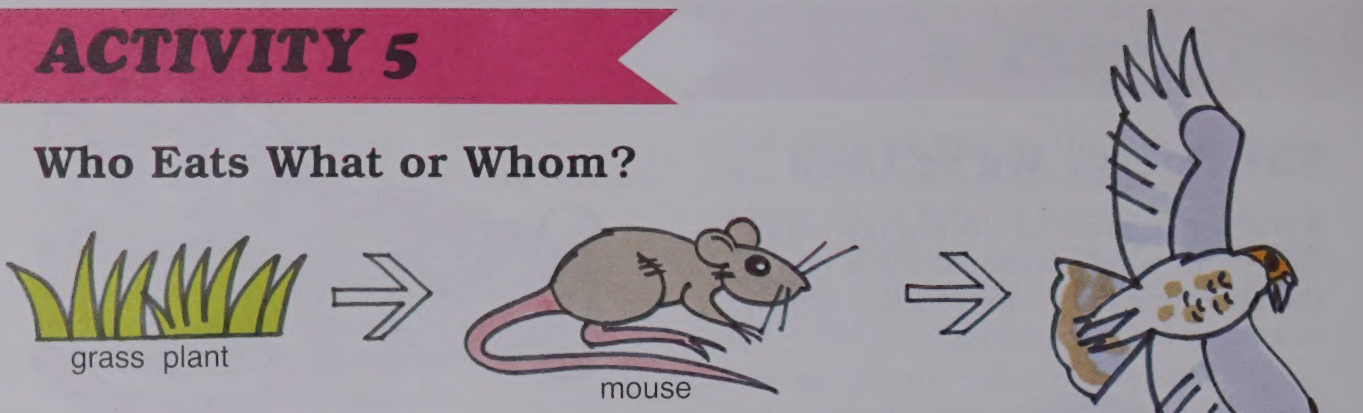


6

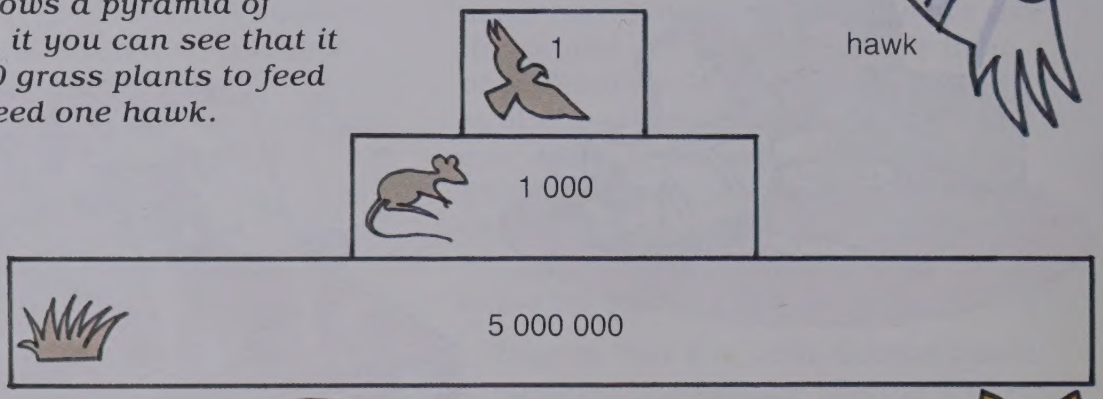
Gasoline gives cars energy to move.
Wind gives kites energy to fly.
Food gives us energy to get out of bed.
Electricity gives us energy to toast bread.
Electricity gives us energy to make the TV work.
Food gives us energy to play.

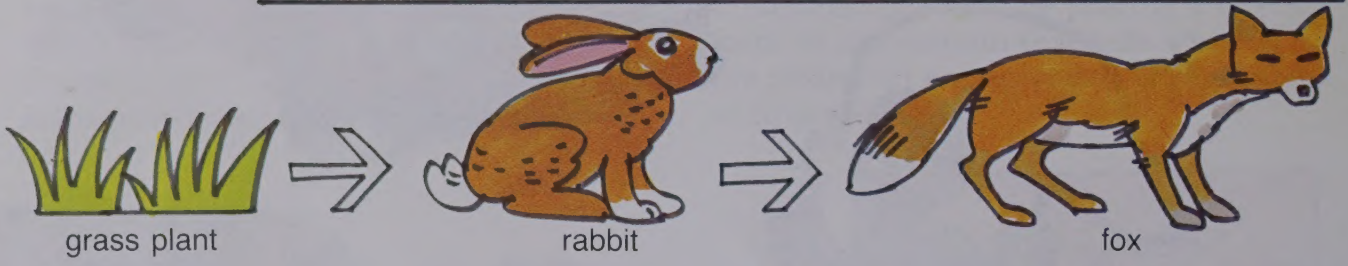
ACTIVITY 5

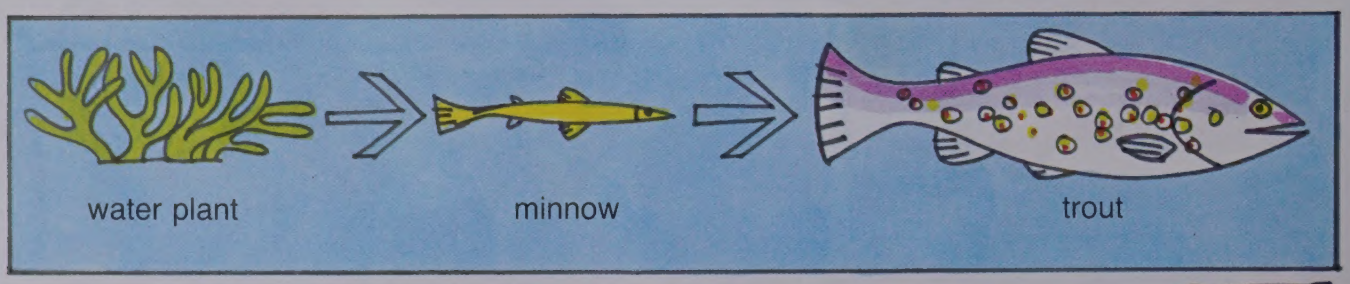
Who Eats What or Whom?

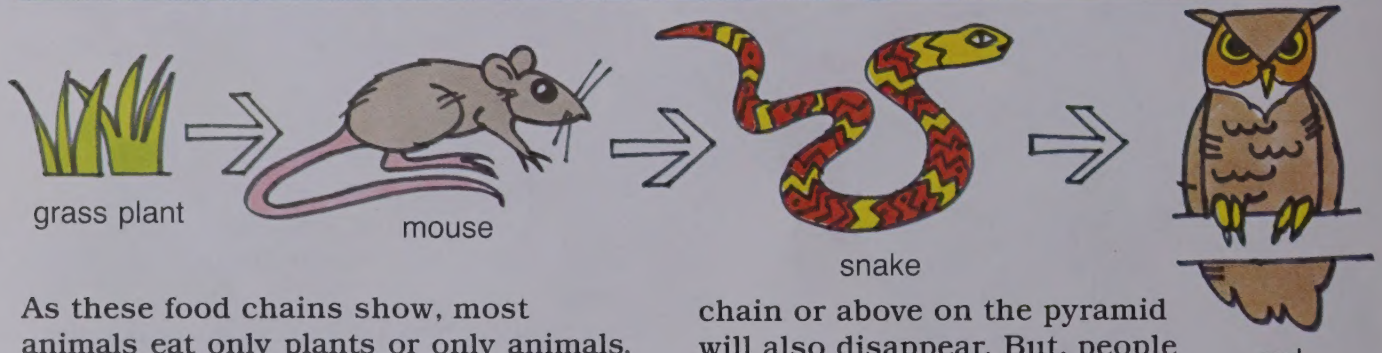


This picture shows a pyramid of numbers. From it you can see that it takes 5 000 000 grass plants to feed 1 000 mice to feed one hawk.









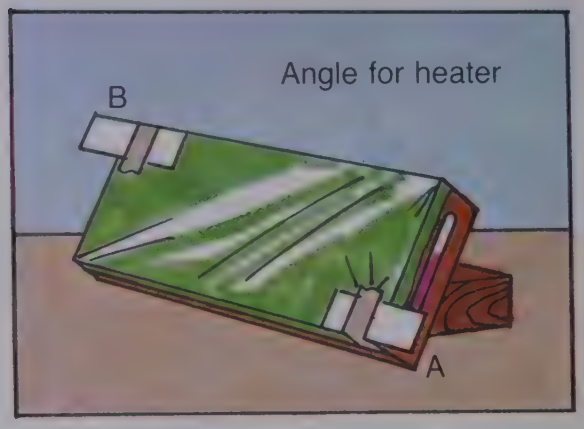
As these food chains show, most animals eat only plants or only animals. If one part of their food chain disappears, the animals next in the chain or above on the pyramid will also disappear. But, people can eat both plants and animals.

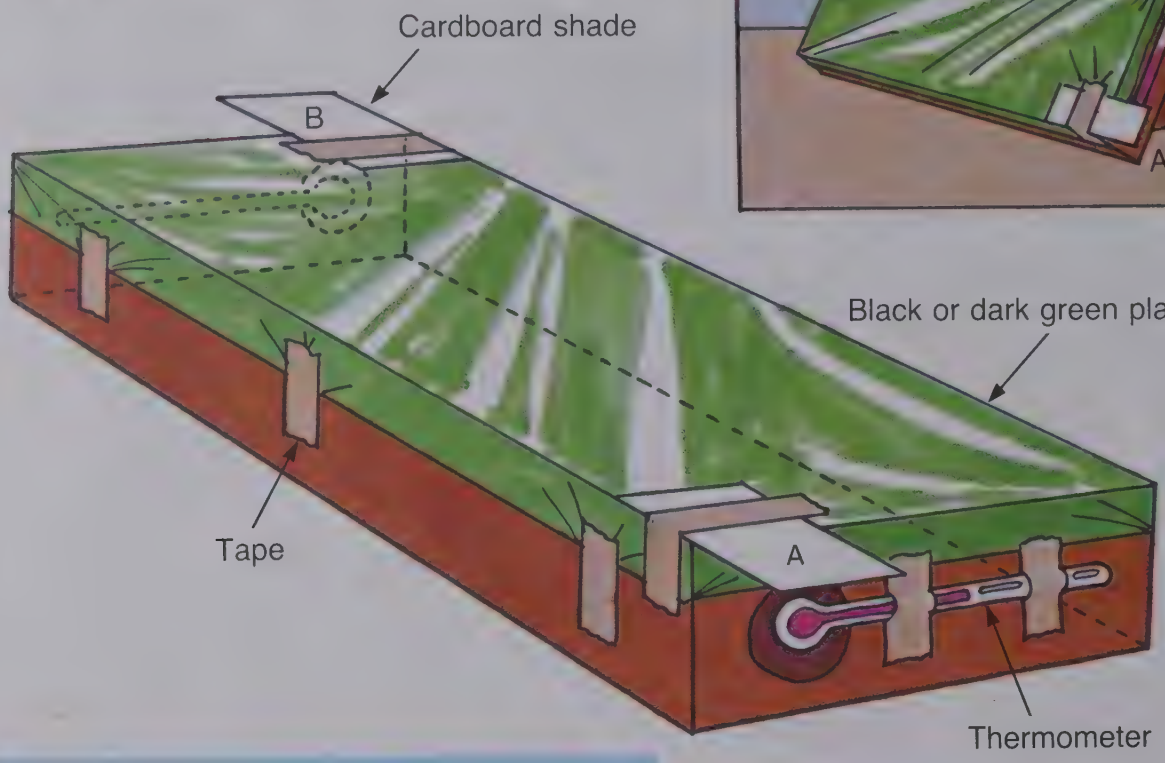
ACTIVITY 6

How the "Web of Life" Can Be Destroyed

ACTIVITY 7

Make Your Own Solar Heater



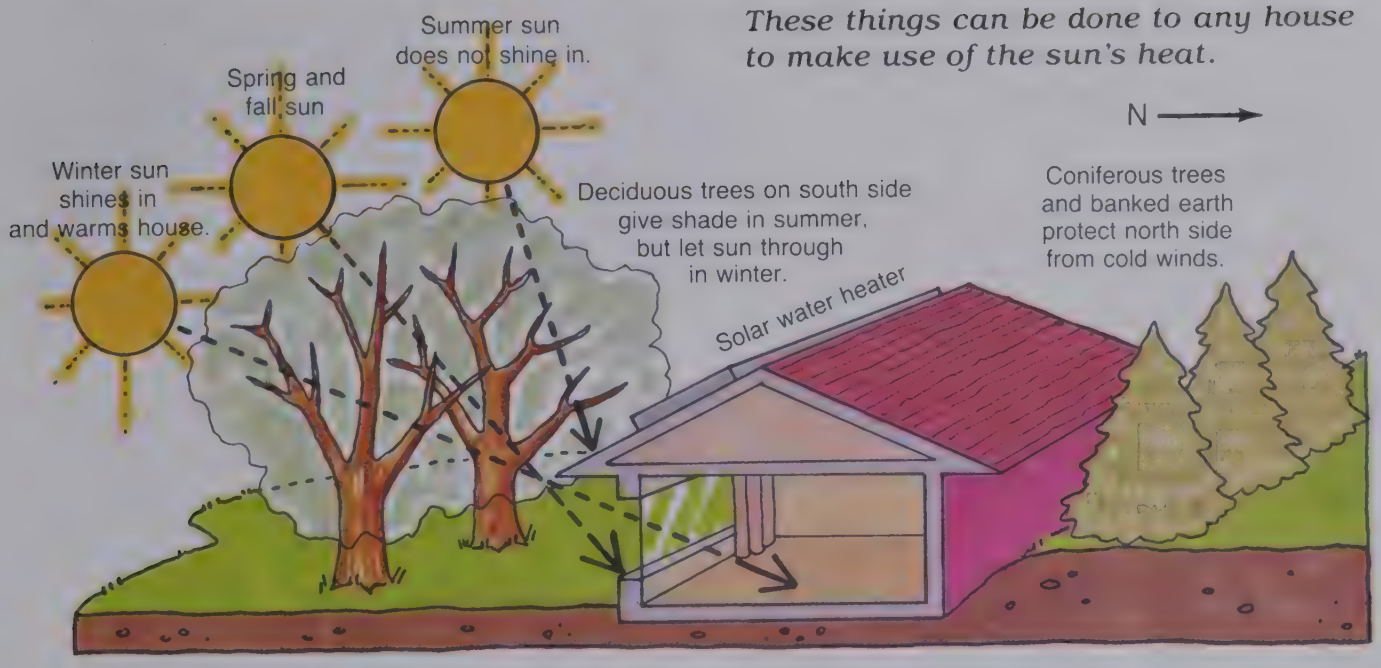


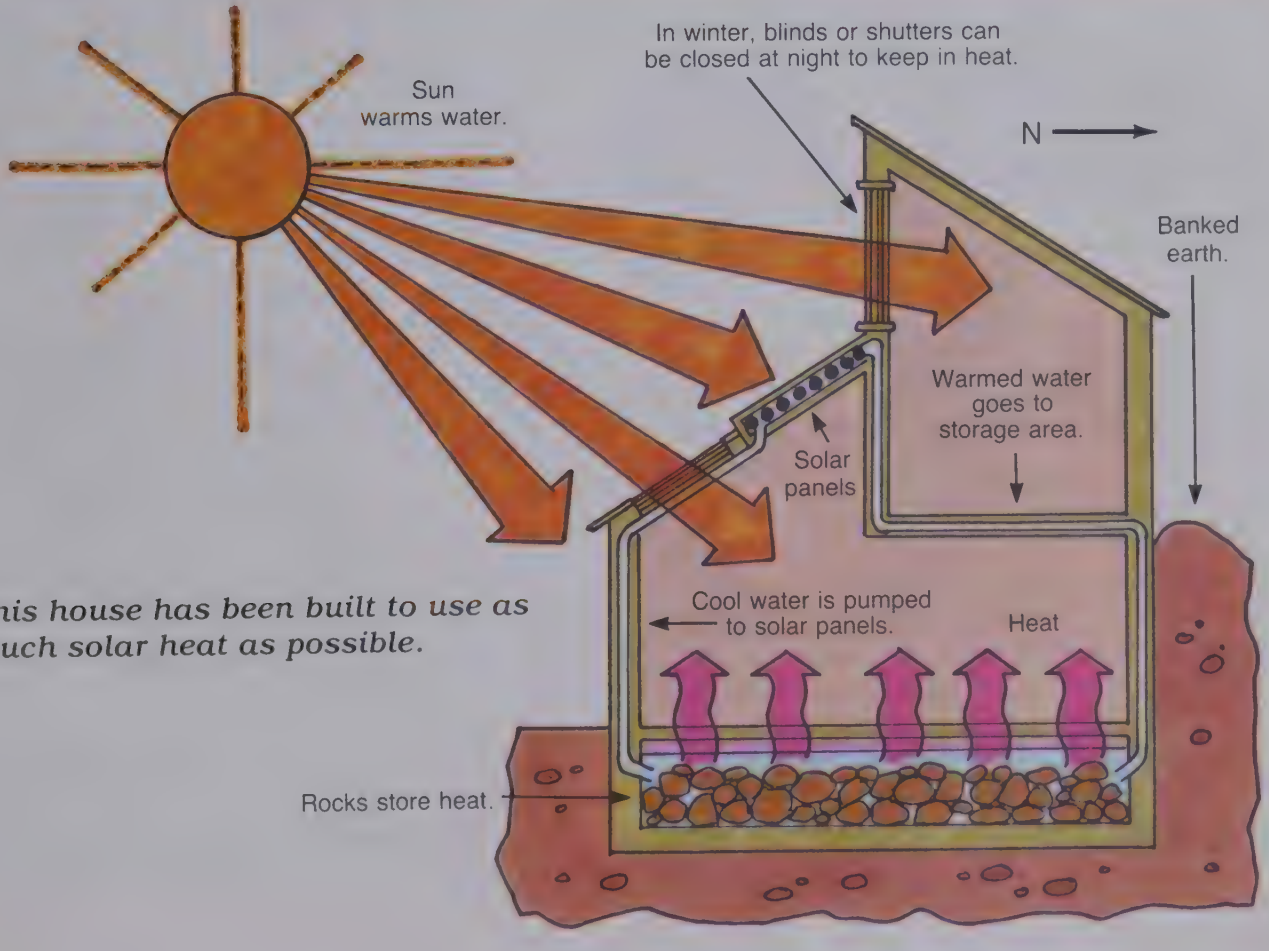
Each group will need:
- 1 shoe box or stencil box
- black or dark green plastic sheets
- 2 thermometers
- 2 small squares of cardboard
- sticky tape

1. Cover the top half of a shallow box with a piece of dark plastic. (A piece of garbage bag will do.) Tape the plastic so it fits tightly over the box.
2. Cut a hole at each end of the box as shown in the picture.
3. Tape a thermometer over each hole. Make sure each bulb is over the middle of the hole.
4. Tape a small square of cardboard over each thermometer bulb to act as a shade. Label them A and B as shown in the picture.
5. Record the temperature for both on Activity Sheet 7.
6. Place your solar heater near the window or outside in the sun. The plastic side must face the sun. Thermometer B should be up.
7. After about five minutes, record the temperatures again.
8. When the temperature of thermometer B has gone up about 5°C, tilt the box at a different angle to see if that makes a difference in the temperature. Keep a record of the temperature each time.
9. Make the holes in the box smaller with a piece of tape. See if this makes a difference. Record the temperatures after the five minutes.
10. Change places with another group and see if this makes a difference.
11. Answer the questions on Activity Sheet 7.

How to Use the Sun to Heat Houses

These things can be done to any house to make use of the sun's heat.


Summer sun does not shine in.
Spring and fall sun
Winter sun shines in and warms house.
N
Deciduous trees on south side give shade in summer, but let sun through in winter.
Coniferous trees and banked earth protect north side from cold winds.
Solar water heater


Sun warms water.
In winter, blinds or shutters can be closed at night to keep in heat.
N
Banked earth.
Warmed water goes to storage area.
Solar panels
Cool water is pumped to solar panels.
Heat
Rocks store heat.

This house has been built to use as much solar heat as possible.

ACTIVITY 8

Water, Water Everywhere

(1) Where does all the water come from? There is water above our heads, in the clouds. Most of the earth is covered by the sea. Even the land is wet for 10 km down.

(2) Most of your body is made of water. The page you are reading from has water in it. One-tenth of a wooden chair is water. Even well-aired clothes have some water in them.

(3) There was no water when the earth was formed. But there were many kinds of gases. Two of these gases were oxygen and hydrogen.

(4) Great heat united these two gases. Together they formed vapor — water in the form of gas. Then the earth began to cool. The vapor changed to a liquid. The water of our world had been made. It has been with us ever since.

(5) The water from your tap has been on earth since the world began. Each drop has a history of millions of years.

(6) Think of one drop of water. It may have been 10 km up in the sky. Perhaps it has spent a million years, 10 km down, in the ground. How many seas has it been in? Maybe next year it will lie on the ground as snow. In a hundred years from now, it may turn up in a carrot.

(7) Water travels a great deal. It moves in rivers to the sea. From the sea it may rise as vapor. Up into the sky it goes. There it may change into tiny droplets. The droplets gather in a cloud. As the droplets cool, they form larger drops. The drops fall as rain. Some drops fall into the sea or into rivers. Others fall on the land and soak into the ground.

(8) Living things suck up water from the ground. It becomes part of them. The water of the world is always on the move. It has to be busy, to keep us alive.

(9) The vapor in the air shields us from the sun. It stops the worst heat of the sun from reaching us. Without it, our blood would boil.

(10) Without water, all living things on earth would die. Without it, we would never have been born.

Do this exercise. Write the numbers 1 to 5. Then write the letter of the correct answer beside the number.

1. When the earth was first being formed
   - **A** the land was wet, 10 km down
   - **B** there was no water at all
   - **C** most of the earth was covered by the sea

2. Water was made in the first place by
   - **A** falling from the clouds as rain
   - **B** living things sucking it up from the ground
   - **C** heat uniting certain gases

3. Each drop of water in the world
   - **A** has existed since the world began
   - **B** will lie on the earth as snow next year
   - **C** is a part of a living creature

4. Water vapor
   - **A** keeps a wooden chair together
   - **B** makes our blood boil
   - **C** keeps the air from being overheated by the sun

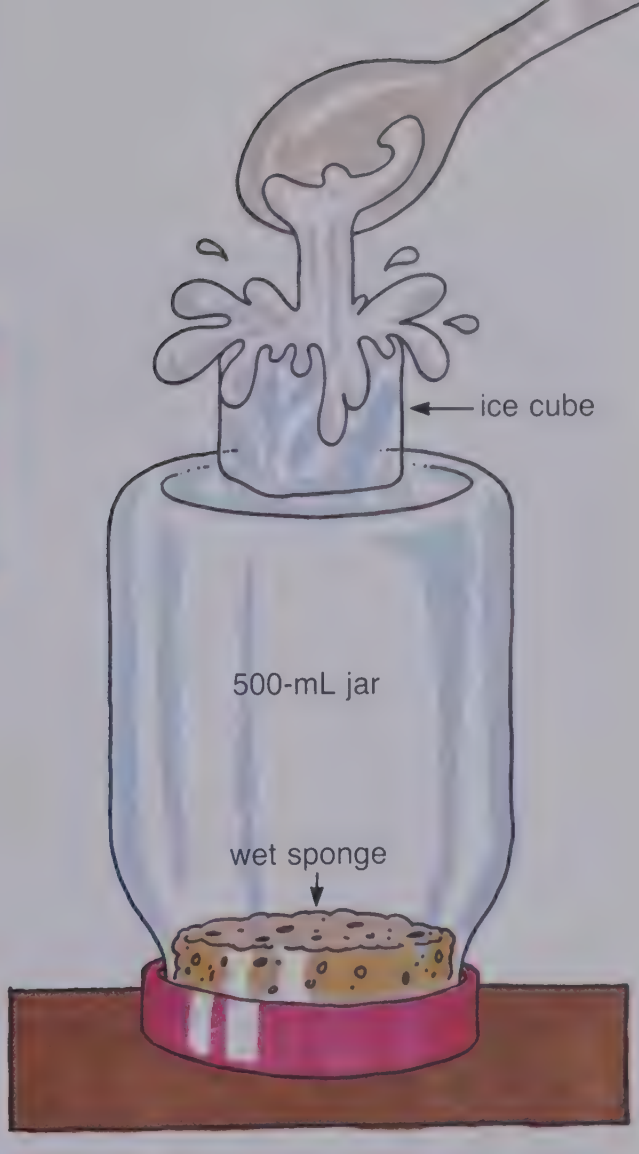
5. Water vapor that rises into the sky may
   - **A** turn into a carrot
   - **B** change into tiny drops of water
   - **C** reach and cool the sun

Investigating the Water Cycle

Each group will need:
- 1 wide-mouth jar with lid (500-mL size)
- 1 small piece of sponge cut to fit lid
- hot water
- 1 ice cube

To see what is meant by "water cycle," do the following:

1. Soak the sponge in hot tap water. Make sure that the sponge is full of water.
2. Put the sponge in the lid.
3. Set the lid on a flat surface where it can't fall.
4. Turn the jar upside down and screw it onto the lid.
5. Put an ice cube on top of the jar. Pour a teaspoon of water over the ice cube. Observe the results and record them on a chart like this one.



After 5 min	After 10 min	After 15 min	Overnight

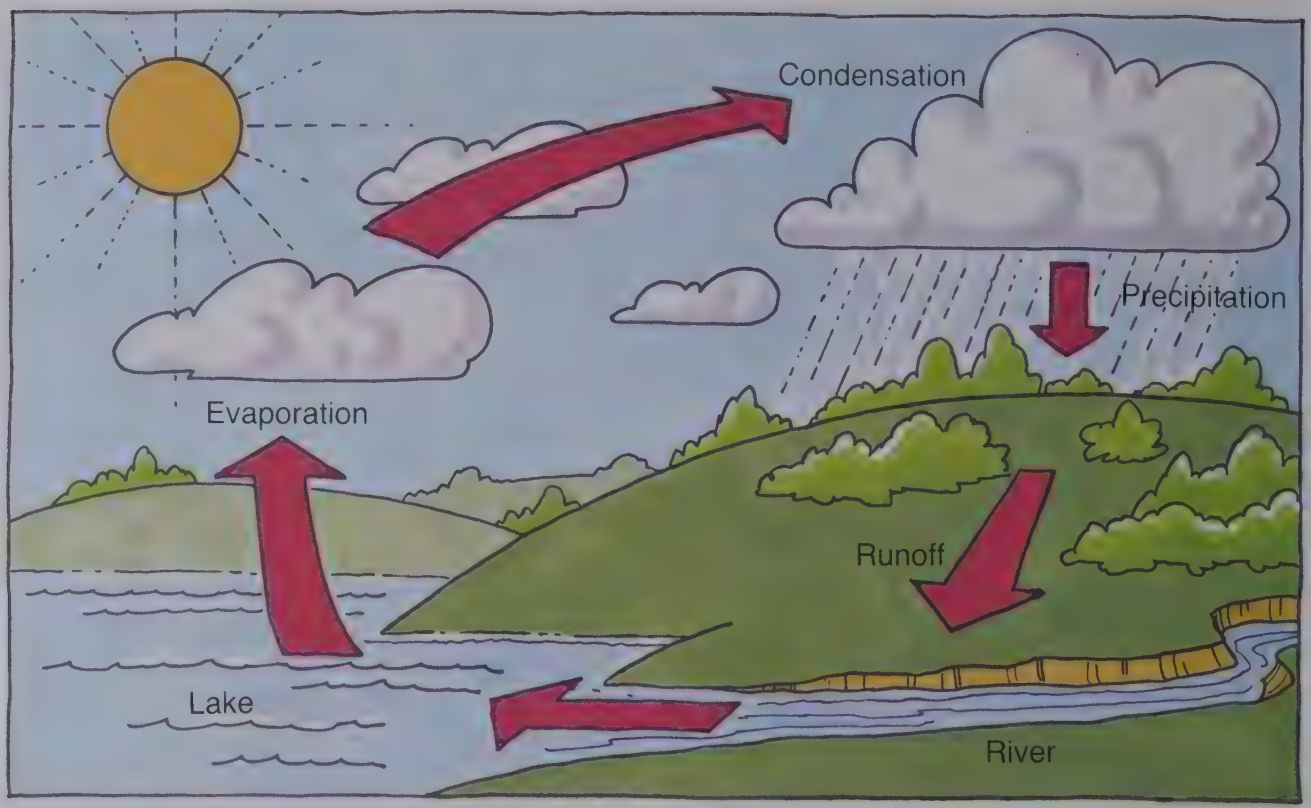
When warm water goes into the air, we say it evaporates.

When water is in the air, we call it water vapor.

When water vapor comes out of the air, or condenses, we call it precipitation.

When water runs into lakes and rivers, we call it runoff.

The Water Cycle

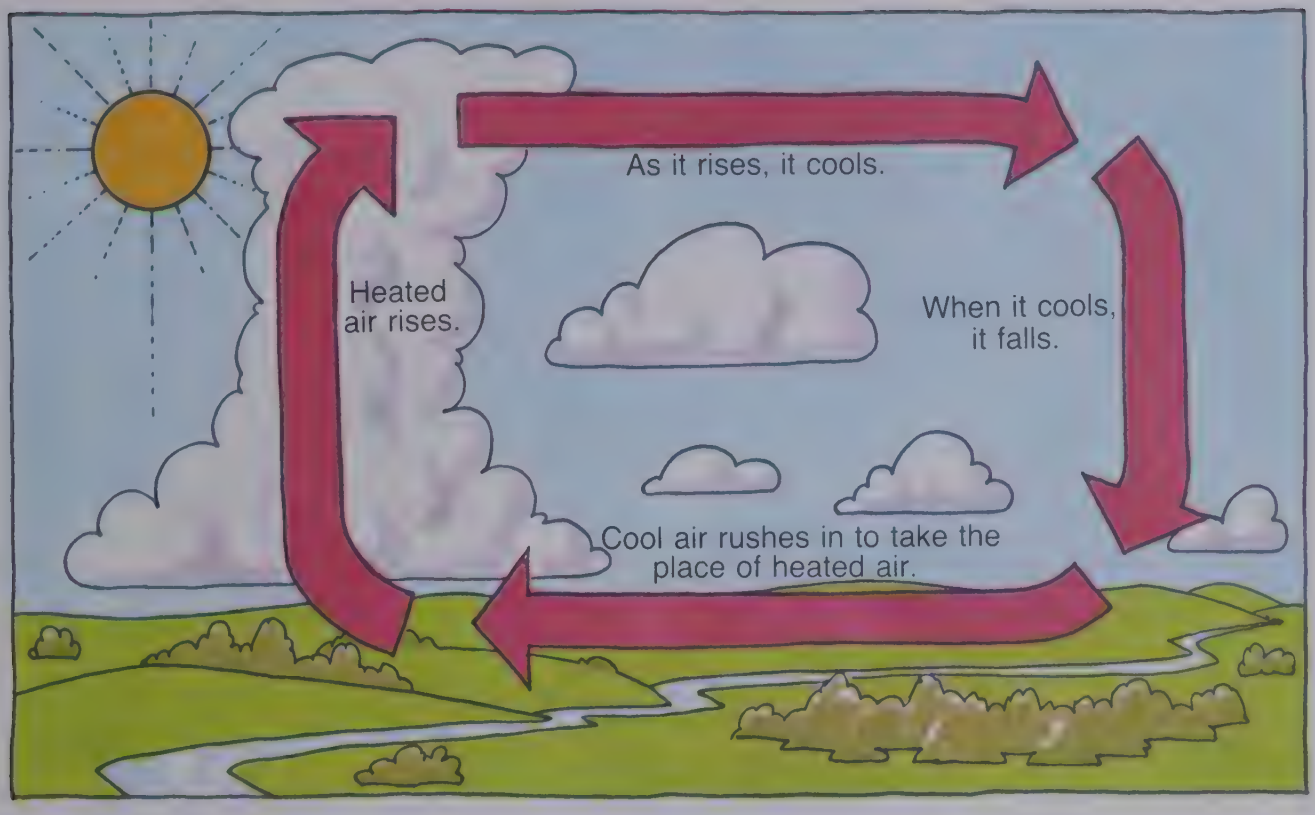


Using Water Energy

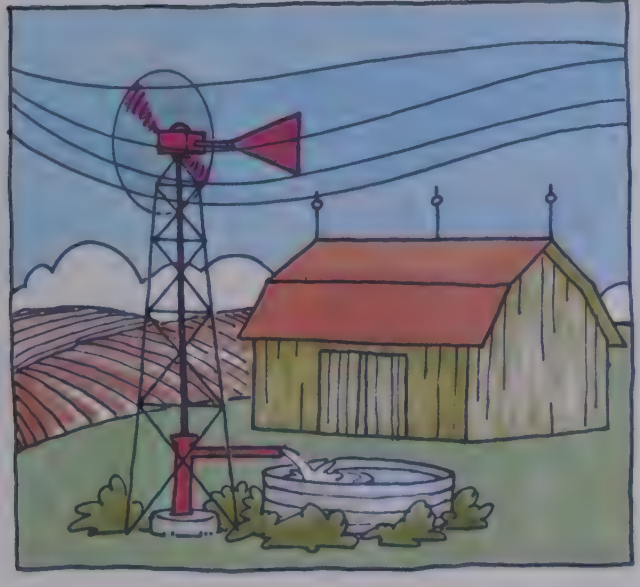
Using the energy of falling water to make electricity is probably our most important use of water power.

ACTIVITY 9

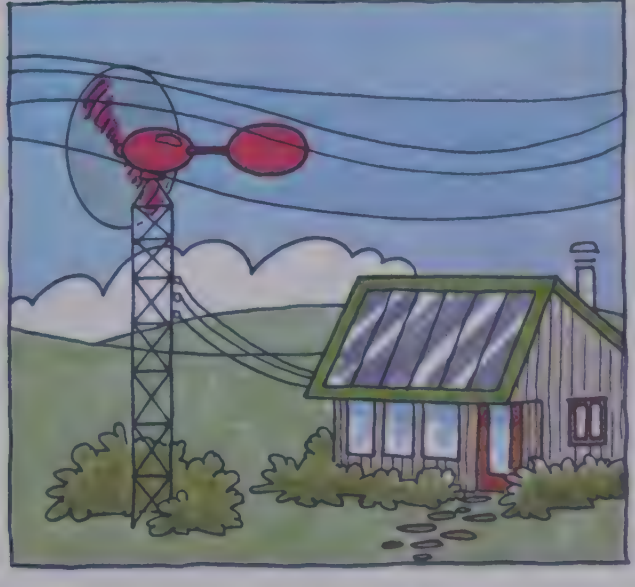
The Wind Cycle



Using Wind Energy: Then and Now



Years ago, many farmers harnessed the energy in wind. They used it to pump water for their animals and crops.



Today's new windmills can generate, or make, electricity. In this way, we can again make use of a renewable source of energy, the wind.

ACTIVITY 10

Wood and How We Use It

We know that the sun is the moving force in the water and wind cycles. We also know that plants need the sun to grow. When we use wood to give us heat, we are using stored energy from the sun. Most of us think that burning wood is the only way to use the energy stored in trees. But many things are made of wood. In fact, some products from wood are the same as those made from fossil fuels. Rubber can be made from the sap of the rubber tree or it can be made from fossil fuels.

Most of the uses of wood are well known. Paper is made from wood pulp. Most houses are built with wooden frames. But did you know that the tree is a source of chemicals? Pine trees are the source of turpentine. It makes paint flow more freely and dry quickly. And, believe it or not, it is also used for making artificial flavors and smells such as lemon, lime, and vanilla.

Other chemicals come from pine trees, too. Pine oil is the base for many cleaning products. Pinewood oil is used to make things smell like pine trees. Tall oil also comes from pines. It is used in floor tiles, plastics, paper finishes, and printing inks — and when you use sticky tape, it is tall oil that gives the tape its stickiness. Tall oil is even added to ice cream and pudding.

Maple syrup and chewing gum come from trees. So do explosives and rocket fuel. They are made from cellulose — the main part of a tree. Cork for bottle caps and bulletin boards comes from the bark of the cork tree. Rayon, a cloth used to make shirts and blouses, is made from wood. In fact, the way wood is changed into rayon is the same as the way fossil fuels are changed into plastics.

The list of the uses of wood could go on and on. But perhaps the nicest thing that we get from a tree is its cooling shade on a hot, hot day. And the most important thing to remember about trees is that they are a renewable energy source. As long as we plant as many as we cut, and look after the ones we plant, we will always be able to use the energy stored in wood. Think about that the next time you eat ice cream or cook a hot dog over a campfire.

Do this exercise. Write the numbers 1 to 5. Then write the letter of the correct answer beside the number.

1. This story is mainly about
   A a nonrenewable energy source
   B the many uses of wood
   C the chemicals we get from pine trees

2. The chemicals we make from pine trees are used
   A in food and drink
   B in cleaning materials
   C both A and B

3. Turpentine is added to
   A paint
   B maple syrup
   C chewing gum

4. The cloth that is made from wood is
   A nylon
   B cotton
   C rayon

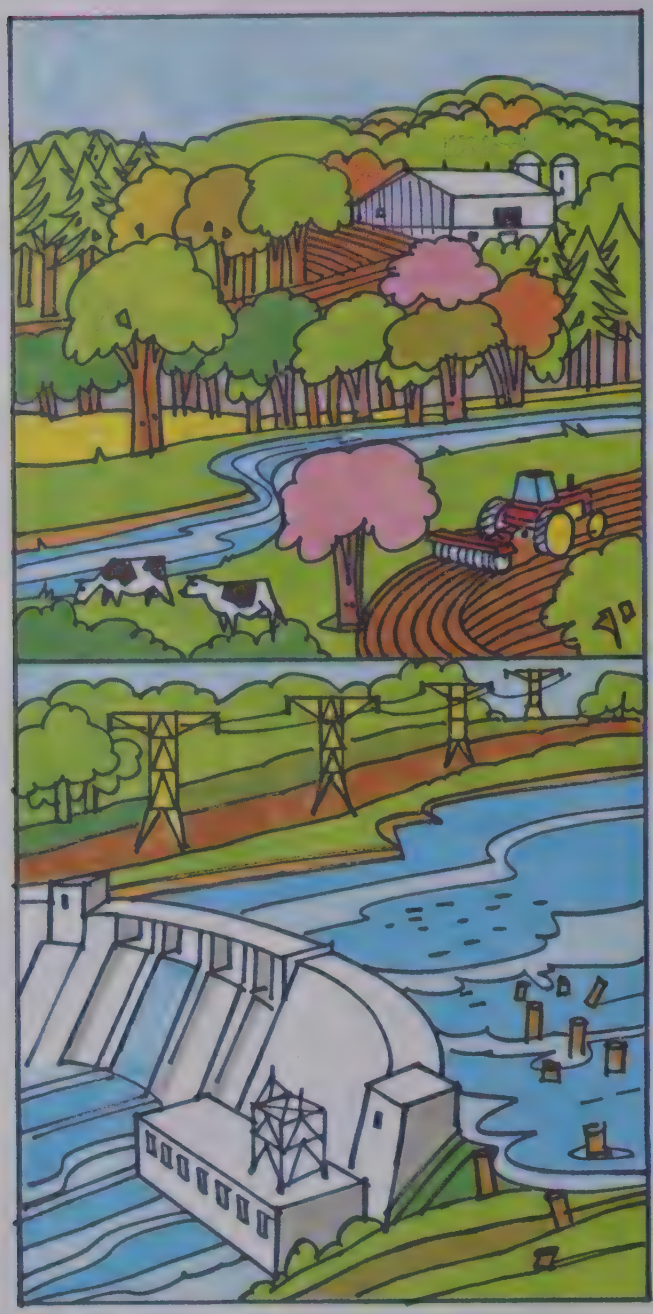
5. Fossil fuels and trees are alike because they both
   A supply fuel energy
   B supply many of the same products
   C both A and B

Building materials
Fruit
Nuts
Cloth
All these things come from trees.
Maple syrup
Chemicals
Rubber
Cooling shade
Paper
Fuel
Turpentine
Sticky tape

ACTIVITY 11

Renewables Aren't Perfect

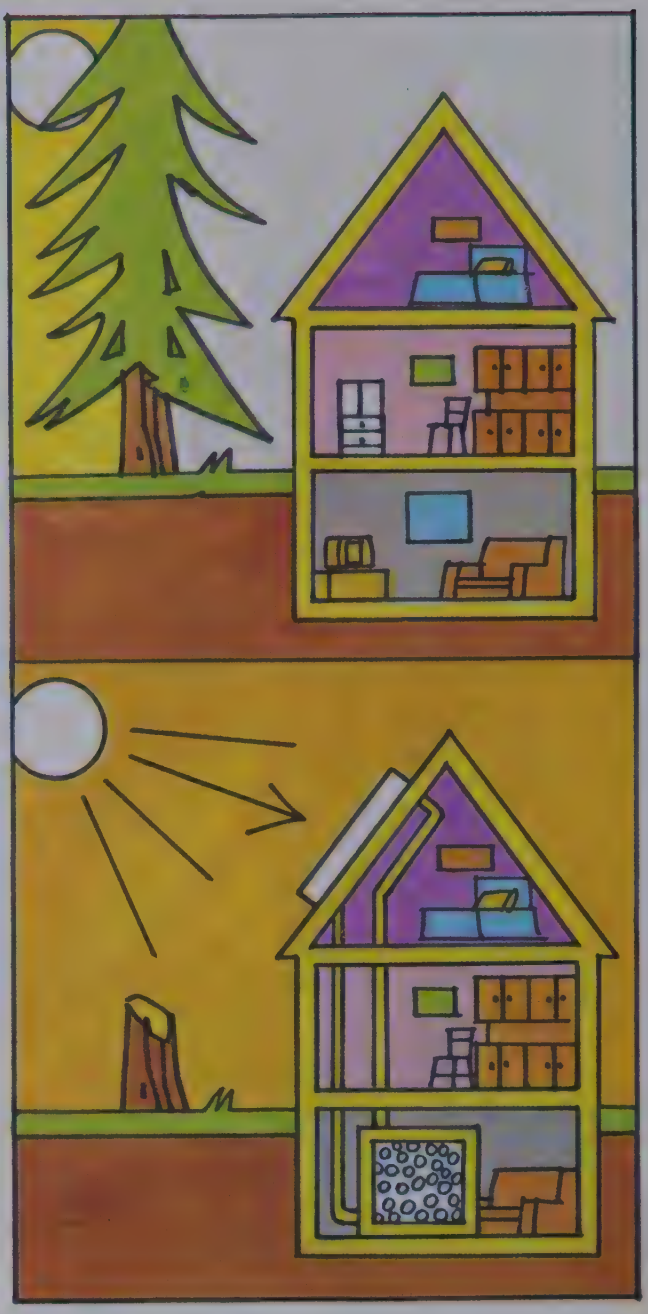
Water: Before



Water: After

River valleys are beautiful to look at. They are home for many animals. Hydroelectric dams destroy river valleys. Trees must be cleared for the power lines and towers.

Sun: Before



Sun: After

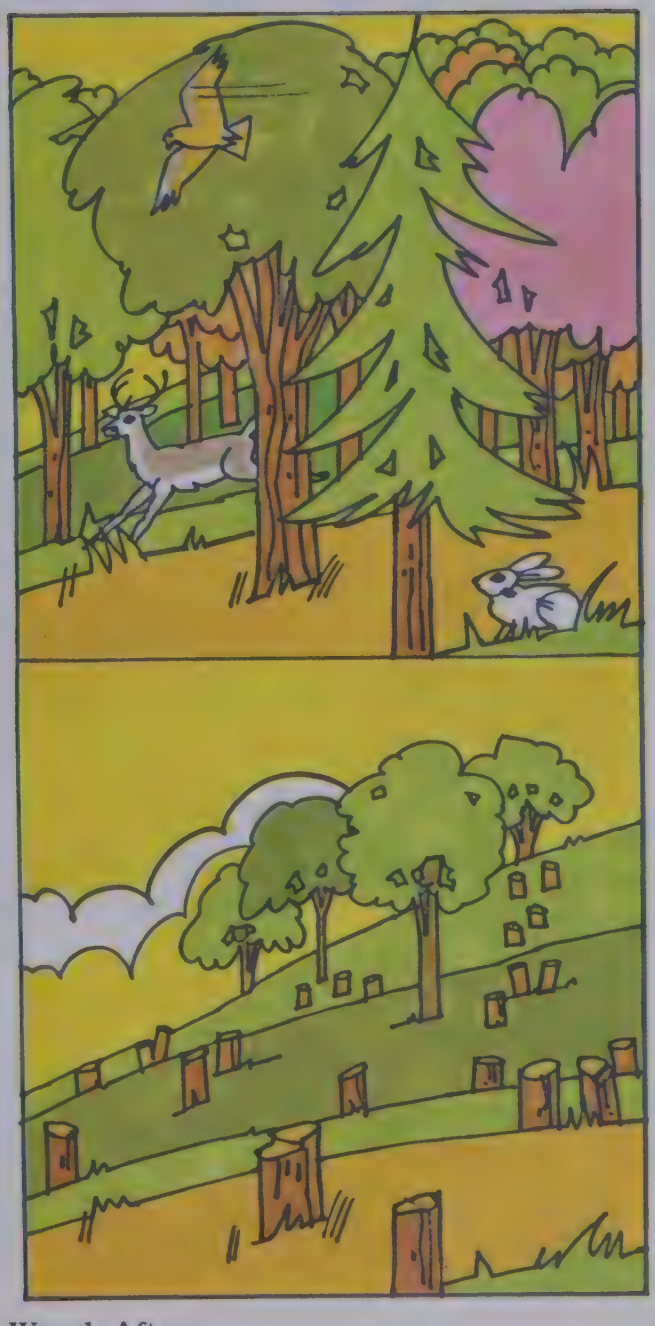
A solar heating system can take up space that the family used before. Trees that shade the solar collectors have to be cut down.

Wind: Before

Wind: After

Tall trees that block the wind must be cut down. Windmills are large and not very attractive.

Wood: Before



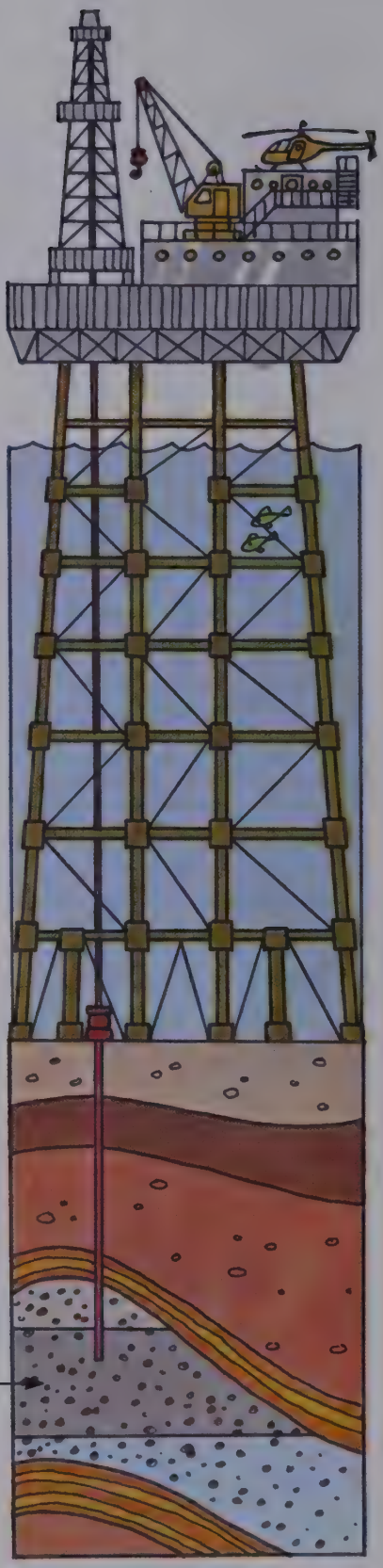
Wood: After

In order to use trees for fuel or other products, they must be cut down. However, wise use of our forests will allow them to last forever and give shelter to forest animals.

ACTIVITY 12

Oil: Getting It Out of the Ground

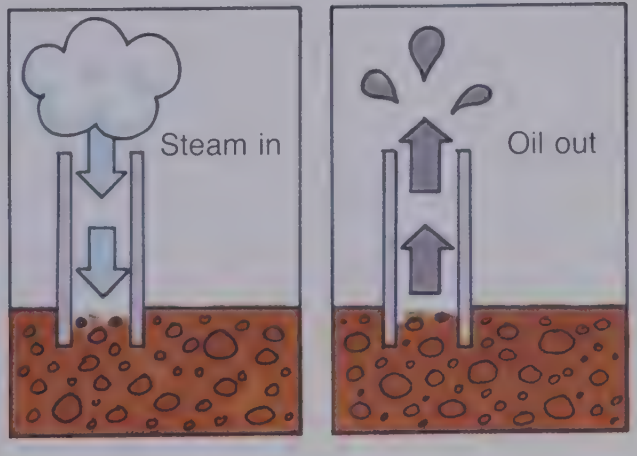
This photograph shows an ocean drilling platform. As many as thirty different wells can be drilled from one platform.



The drawing on the right shows what is beneath an ocean-drilling platform. On a deep well the drill may go down as deep as 3 km to reach oil. The oil is trapped in sponge-like rock. Water is below the oil and natural gas is above it.

This is an artificial island. Islands like this have been built for use as drilling platforms in the shallow parts of the Beaufort Sea. In time they will be washed away.

To mine the oil sands, huge machines called draglines scrape up the oil sand so that it can be taken away to be separated.



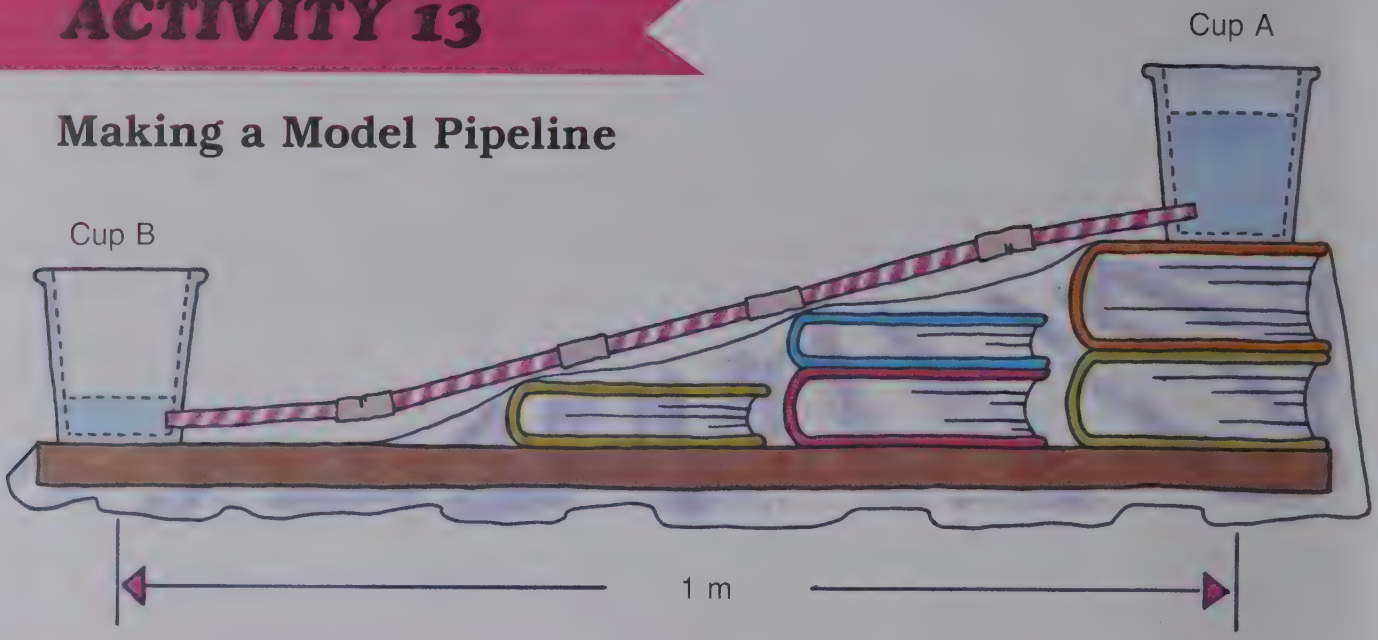
This is a method of extracting oil called "Huff and Puff." Some oil is so thick that it can't be pumped out of the ground. To get this oil out, steam is forced into the well. This heats the oil so it flows more easily. The steam also helps push the oil up out of the ground.

Answer these questions:

1. Why is drilling wells expensive?
2. How many wildcat wells produce oil?
3. What problems do you think drillers might have on the ocean?
4. Why are artificial islands built?
5. Why is mining the oil sands more costly than drilling for oil?
6. Why is the using of steam to pump out oil called "Huff and Puff?"

ACTIVITY 13

Making a Model Pipeline



Each group will need:
- 5 paper towels
- 2 foam cups
- 1 m plastic wrap
- 4–8 drinking straws
- 100 mL of colored water
- 1 m masking tape
- 1 measuring cup
- several books

1. Set up the books so that Cup A and Cup B are 1 m apart. Place Cup A so it's about 10 cm above Cup B.
2. Cover your working area with plastic wrap so the books won't get wet. This is where you will lay your pipeline.
3. Build your pipeline of straws using masking tape to join the straws.
4. Place a small patch of masking tape near the bottom of each cup. Using a pencil, punch a small hole in close to the bottom of each of the cups, through the tape. Insert the straws in the holes.
5. Test your pipeline by pouring the 100 mL of water into Cup A (see diagram) and watch it go into Cup B (see diagram).
6. Measure the amount of water that is now in Cup B.
7. If your pipeline leaked, clean up the spills, repair the pipeline, and try again. Ask your teacher for more straws if your old ones cannot be repaired.

Answer these questions:

1. Did the straw pipeline leak? If so, where?
2. How much water was placed in Cup A? How much reached Cup B? How much was lost (subtract amount in Cup B from amount in Cup A)?
3. Where did the extra water go? How could a water spill be cleaned up?
4. If this were oil, do you think it would be as easy to clean up? Why or why not?
5. How could you stop the pipeline from leaking?

Digging the hole.

Wrapping the pipe.

Lowering the pipe.

Checking for leaks.

ACTIVITY 14

Coal: Getting It Out of the Ground

Like oil and natural gas, coal is found in layers (called seams) between layers of sedimentary rock. It too was formed from the bodies of plants that died millions of years ago. The bodies of these once-living things contained carbon as well as other chemicals. As the plants were changed into coal, most of the other things were squeezed out, leaving carbon. Carbon is what burns in coal and oil.

We use coal and products made from coal every day. Power plants burn coal to make much of our electricity. Coal is used in making steel. Many chemicals are made from coal, coal gas, and coal tar. Even gasoline can be made from coal.

But before we can use coal, we have to get it out of the ground. There are two main methods, much like the methods used to get oil out of the ground. If the coal seam is deep under the ground, a shaft (tunnel) is dug down to it, just as a drill hole is made to bring oil up. If the coal seam is near the surface, the soil over it can be scraped away, just as the soil over the oil sands is scraped away. Then the coal can be removed.

The pictures at the bottom of this page show a deep shaft mine and a strip, or surface, mine. Both methods of mining coal cause problems. Strip mines can spoil the surface of the earth. Underground mines are not as ugly or as harmful to the land as strip mines. But cave-ins, dangerous gases, and coal dust cause health problems for the miners.

Deep shaft mine

Strip mine

These photographs show some of the large machines used in both kinds of mines. The machine on the right is called a continuous miner. The rotating teeth on the front of the machine tear out the coal. Arms on the lower part pull the coal onto a conveyor that carries it through the machine. The coal is then loaded onto a small car or directly onto a conveyor belt, shown in the photograph below. This long, moving machine takes the coal out of the mine.

Even though all this machinery has made underground mining much simpler and safer, many miners still die in cave-ins or explosions.

Strip mining is easier and safer. Huge electric shovels like the one shown below, remove the dirt and rock from the coal seam. This huge earth mover, called a walking dragline, can move 6000 m^3 of earth and rock per hour. The coal is broken up by explosions and removed by smaller shovels that dump it into huge dump trucks.

Once the coal is mined, it is taken to a plant where it is washed, sorted into different sizes, and finally shipped to where it will be used.

ACTIVITY 15

Reclaiming the Land

A giant shovel takes a big bite of earth and dumps it to one side. The shovel gnaws its way into a shallow seam of coal. But what happens to the earth when all the coal is gone? If it is left in that torn-up state, the earth will wash into the streams and poison them with minerals. Nothing will live on the land because nothing grows there — the "web of life" has been broken. Only ugly, slate-gray slopes remain.

For many years, mining companies did nothing more to the land. Now, however, laws have been passed forcing mining companies to put the landscape back together again. This is done by smoothing the great humps left by the giant shovels to make them level. Then fertile topsoil is spread over the site. Once the land is fertile, crops such as grass or alfalfa can be planted.

In some parts of North America, planting trees on old mine sites has been very successful. New ponds make homes for ducks and fish. Some old mine sites have been made so attractive that they have become favorite picnic spots for families.

This process is called reclamation because the land is reclaimed — taken from a useless state and made useful again. Once all the parts of the "web of life" are put back on an old mine site, the land can support life again. Of course, the land will not be exactly as it was before mining. But in some cases, it can be even more useful for grazing cattle or growing crops than it has been before.

Answer these questions:

1. What does the word "reclamation" mean?
2. How does surface mining affect plants? animals? air? water?
3. Why have laws been passed to make mining companies reclaim the land they have mined?
4. How do mining companies reclaim the land?
5. How does reclamation affect plants? animals? air? water?

ACTIVITY 17

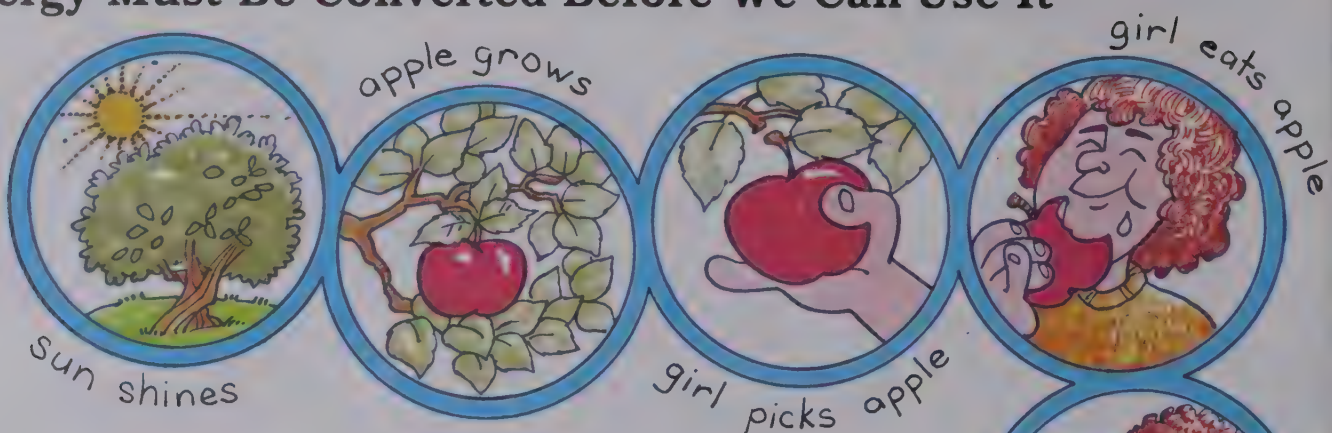
The Energy We've Used

We've All Wasted Energy By —

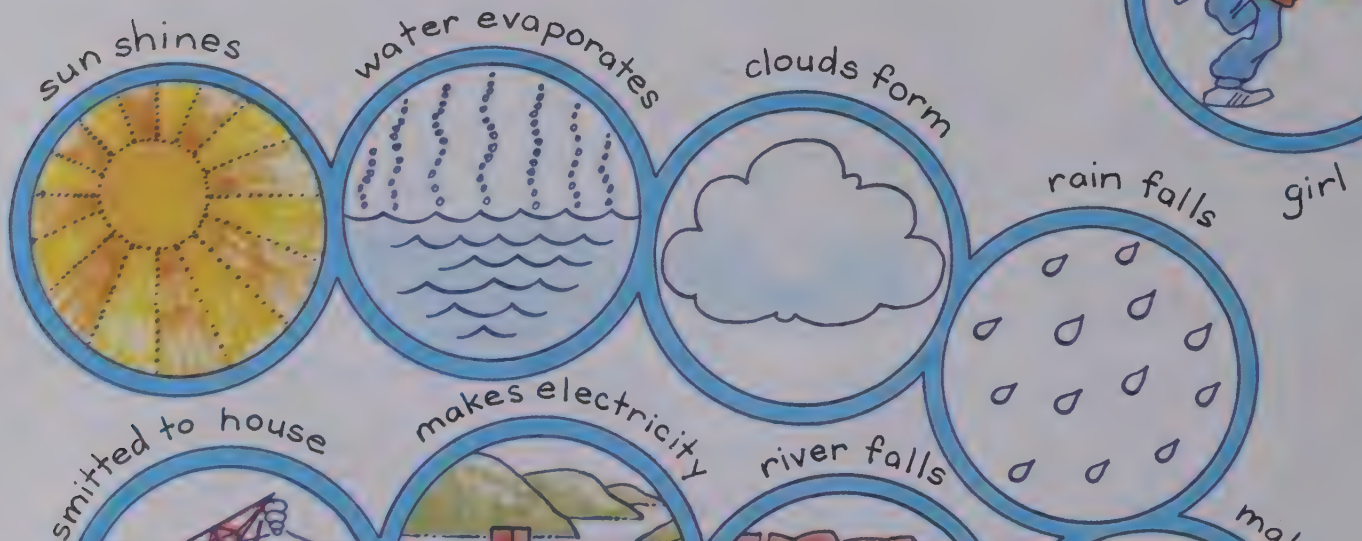
Everyone Could Save Energy If They —

ACTIVITY 18

Energy Must Be Converted Before We Can Use It



Which chain is the longest? Why?



ACTIVITY 19

Cracking the Code

In your notebooks, copy the code and its numbers as you see them here.

1	2	3		4	5	6	7	8	9		10	11	12	13	14	15
W	U	G		G	P	G	T	I	A		Y	K	U	G	N	A

To solve the code, read each pair of sentences. Decide which of the two sentences is true. Put the letter that follows the true statement under the code letters you have written.

1. There are three fossil fuels. **U**
   There are more than three fossil fuels. **T**
2. Wood, water, and wind are renewable sources of energy. **S**
   We are running out of our renewable sources of energy. **P**
3. The wind is the moving force in the water cycle. **K**
   The sun is the moving force in the water cycle. **E**
4. When water vapor comes out of the air, it evaporates. **V**
   When water goes into the air, it becomes a vapor. **E**
5. Both coal and oil can be found close to the surface or deep under the ground. **N**
   Both coal and oil are extracted by the same machines. **M**
6. Oil and natural gas are taken from place to place in pipelines. **E**
   Pipelines never leak. **O**
7. Strip mining changes the environment. **R**
   Reclamation makes the land just as it was before mining. **F**
8. All living things have a place in a food chain. **G**
   If one link in a food chain breaks, nothing will happen. **T**
9. Green plants use the sun's energy to make food. **Y**
   Green plants are the consumers in the food chain. **F**
10. Wood is only useful as a source of heat. **P**
    Many chemicals can be made from wood. **W**
11. Oil is found in pools under the ground. **O**
    Oil is found in porous rock under the ground. **I**
12. Coal has always existed under the earth's surface. **E**
    Coal was formed millions of years ago from the bodies of plants. **S**
13. Using any source of energy can cause some change in the environment. **E**
    Using renewable sources of energy does not cause changes in the environment. **V**
14. We should use all the energy we can. **X**
    We should use energy sources wisely. **L**
15. The sun is the prime source of energy. **Y**
    Green plants are the prime source of energy. **Z**

Vocabulary List

A angle 7
artificial 10
artificial island 12
attractive 11

B biomass 1
bit 12
bulb 7
by-product 10

C carbon 14
cellulose 10
chemicals 10
coal 1
condense(s)(ed) 8
connect(ed)(ion) 6
coniferous 7
consume(er) 5
continuous miner 14
conversion chain 18
conveyor belt 14
crude oil 1

D deciduous 7
derrick 12
drilling rig 12

E effects 11
electricity 1
energy 1
evaporate(ed)(ion) 8
explosives 10

F fertile 15
food chain 5
fossil fuel 1

G generate 9

H "Huff and Puff" 12
hydroelectricity 1

L location 7

M minerals 15

N natural gas 1
nonrenewable 2
nuclear 2

O oil sands 12

P pipeline 13
platform 12
porous 12
position 7
precipitate(ion) 8
produce(er) 5
pyramid 5

R rayon 10
reclaim 15
reclamation 15
refinery 13
renewable 2
rotate(ing) 14
runoff 8

S seam 14
sedimentary rock 14
seismograph 12
shaft 14
shallow 7
shelter 11
solar 7
sponge 8
strip mining 14
system 11

T temperature 7
thermometer 7
tilt 7
turpentine 10

V vapor 1

W web of life 6
wildcat well 12
windmill 11

QC 73-6 S13 1981 GR-4 C-3
SEEDS THE ENERGY LITERACY
SERIES/

39531029 CURR

00001028869 4

RECOMMENDED FOR USE
IN ALBERTA SCHOOLS

QC 73.6 S13 1981 gr.4 C. 3
SEEDS :

39531029 CURR

FOR LIBRARY USE ONLY

B21501

Society, Environment & Energy Development Studies

SEEDS 4

SRA

Reorder No. 3-280442
ISBN 0-574-09442-3